**ORIGINAL ARTICLE**

**Robert Stefko**
*University of Prešov in Prešov, Slovakia*
 *orcid.org/0000-0002-0650-7780*

**Richard Fedorko**
*University of Prešov in Prešov, Slovakia*
 *orcid.org/0000-0003-3520-1921*

**Radovan Bacik**
*University of Prešov in Prešov, Slovakia*
 *orcid.org/0000-0002-5780-3838*

**Martin Rigelsky**
*University of Prešov in Prešov, Slovakia*
 *orcid.org/0000-0003-1427-4689*

**Maria Olearova**
*University of Prešov in Prešov, Slovakia*
 *orcid.org/0000-0001-9086-7975*

# Effect of service quality assessment on perception of TOP hotels in terms of sentiment polarity in the Visegrad group countries

**Abstract**

**Research background:** In the developed countries, the services sector, which also includes the accommodation services, is a significant source of the gross national product. Tourism can be perceived as an important determinant of countries' economies, so attention paid to the needs of clients is at least necessary and beneficial.

**Purpose of the article:** The aim of the study is to assess the quality of services provided and the perception of the hotel from the point of view of the accommodated clients. This objective was fulfilled by determining the effect of selected indicators of perception of the quality of provided services (location, personnel evaluation, cleanliness, equipment, comfort, price/quality ratio of provided services, free Wi-Fi connection) on the indicator determining the perception of the hotel (polarity of sentiment).

**Methods:** In the analysis of the above, 22,000 text-reviews of 117 five-star hotels of the Visegrad Group countries were evaluated. The hotel reviews were obtained from Tripadvisor.com and indicator rankings from Booking.com. The analysis made use of the regression analysis methods — influence (regulatory models — Ridge, Lasso, Elastic net, and multiple linear regression — OLS).

**Findings & Value added:** It has been found out that hotel equipment and cleanliness have the greatest effect on the polarity of sentiment. As could be expected, the trend has an upward tendency — that is, as quality increases, so does the sentiment polarity — the perception of hotel facilities. Overall, the analysed sentiment variables can be considered positive, as was confirmed by the positive coefficients of the coherence analysis (Spearman-$\rho$; Pearson-r), as well as the upward trend in the predictions under the regression analysis. Hotels should be strategically customer-oriented and, as the analyses show, pay the greatest attention to equipment and cleanliness. The services of accommodation facilities are dominant in terms of satisfaction with the destination in general, so in the long run, they should be given due attention. These findings are particularly beneficial for hotel services provided in the Visegrad Group countries, as no research studies have yet been carried out on customer evaluation of the quality of accommodation facilities using the presented methods.

## Introduction

As tourism is becoming a key determinant for the growth of cities and countries, understanding tourist behaviour provides further information on how to increase tourists' satisfaction and how to attract loyal visitors (Yoon & Uysal, 2005, pp. 45–56). Thus, one way of improving tourism/ is to better understand customers through ratings and reviews. Online customer ratings play a key role in the tourism industry (Xie *et al*., 2014, pp. 1–12). As a specific form of eWOM, they have become the most important source of information in customer decisions (Ye *et al.,* 2011, pp. 106–118; Štefko *et al.,* 2016, pp. 153–163). They are considered more successful in influencing consumer behaviour than traditional marketing, merchant information, or promotional website news (Gretzel & Yoo, 2008, pp. 35–46; Yang & Mai, 2010, pp. 1050–1057). Ratings and reviews provide customers with a rich source of information on product quality from the perspective of other (unexposed) customers with similar preferences (Li *et al*., 2013, pp. 101–136). Online consumer reviews are also a valuable source of information for organizations (Štefko *et al*., 2015, pp. 177–185). They help influence brand perception and manage customer relationships (Papathanassis & Knolle, 2011, pp. 215–224). From the perspective of potential customers, these reviews are considered authentic, trustworthy, useful,

and necessary (Li & Hitt, 2008, pp. 456–474). In general, they are considered to be more honest, impartial, and comprehensive than the information provided by organizations themselves. Thanks to such reviews, organizations may even supply missing information customers look for (Bhandari & Rodgers, 2018, pp. 125–141).

Customer reviews directly affect tourism and hospitality, as quality is only perceived after consumption (Lopes *et al.,* 2014, pp. 151–154; Ye *et al*., 2009, pp. 180–182). Online reviews provide useful information about customer satisfaction. Many studies have therefore defined attributes that measure service quality and its effect on customer satisfaction (Berezin *et al.*, 2016, pp. 1–24; Emir, 2016, pp. 706–720; Hemsley-Brown & Alnawas, 2016, pp. 2771–2794). The quality of service has been shown to correlate with overall guest satisfaction (Stringam *et al*., 2010, pp. 773–796; Poon & Low, 2005, pp. 217–227). The higher the hotel rating, the more satisfied the customer is (Bulchand-Gidumal *et al*., 2013, pp. 44–47). Some attributes, such as room amenities/ equipment, value for money, location, service, and personnel have been identified as key attributes that underlie customer satisfaction (Chaves *et al*., 2012, pp. 1286–1287; Zhou *et al.,* 2014, pp. 1–10). According to Li *et al*. (2013, pp. 101–136), customer satisfaction, from the point of view of tourism, is perceived as a holistic emotional response to the intangible service provided. Therefore, many research studies in tourism and hospitality research has attempted to understand customer satisfaction with the quality of hotel services provided based on the content of online customer reviews. The presented article aims to broaden this research base by examining the effect of selected service quality attributes on the sentiment polarity of reviews, focusing on TOP hotels located in the Visegrad Group countries.

The presented paper deepens the knowledge in the field of tourism by adding relevant empirical evidence that reveals the customer's perception of hotel quality attributes in a yet unexplored research context — in the V4 countries environment, which can be considered the greatest added value of the presented paper. From this aspect, the paper provides data on the state of hotel services in the given regions and suggests the ways to improve tourism in these countries.

For this purpose, we applied regression analysis and correlation analysis from which the assessment of effects as well as their quantification is expected. Several regression methods were applied and these methods were subsequently verified. Relationship analysis was also performed in a parametric as well as non-parametric form. These procedures were applied in order to minimize the errors caused by the selection of the statistical tool. It is important to note that the analyses included very valuable data in the

form of polarity sentiment (positive or negative perception of the hotel), which was obtained directly from the reviews (text) of hotel customers. This emphasizes the specificity of the study compared to other similar ones. It is also appropriate to point out the high number of evaluations, i.e. observations that entered the analyses. This fact ensures a relatively high reliability of the results. The following section is devoted to the analysis of the current theoretical basis. This section is followed by a methodological part determining the main goal of the research, data, methodology and statistical tools used. The part with the research results shows the applications of these methods and the conclusion is devoted to practical implications, as well as a comparison of our results with the studies of other authors.

## Literature review

In the hotel industry, studies have focused on analysing online customer reviews from different perspectives, including customer satisfaction (Hasegawa, 2014, pp. 15–35), customer behaviour in complaints (Ekiz *et al*., 2012, pp. 96–106; Va´squez, 2011, pp. 1707–1717), or service failure (Lee & Hu, 2004, pp. 167–181; Sparks & Browning, 2010, pp. 797–818). The importance of various hotel attributes has been thoroughly researched and discussed in many studies. The studies which focused on the effect of hotel attributes on the satisfaction rating gave us the most common factors determining satisfaction. According to Choi and Chu (2001, pp. 277–297) and other studies, the attributes include staff quality, room quality (Shankar *et al*., 2002, pp. 325–344), and value for the money paid (Mohsin & Lockyer, 2010, pp. 160–173). Numerous studies suggest that customer satisfaction plays an important role in motivating customer loyalty and in willingness to leave a positive review, recommendation or even to consider returning (for example Kim *et al*., 2009, pp. 10–17; Hui *et al*., 2007, pp. 965–975). Previous research in the tourism and hospitality industry (e.g. Callan & Kyndt, 2001, pp. 313–323; Lockyer, 2003, pp. 297–305) has identified attributes such as room cleanliness, comfort, location, value for the money paid and the friendliness of staff as important for the quality of hotel services. Rauch *et al*. (2015, pp. 87–106) stressed the importance of the appearance of hotels, and Berezin and Cobanoglu (2010, pp. 25–37) claim that one of the most important attributes is the technical facilities of the hotel. Victorino *et al.* (2005, pp. 555–576) found out that the access to the Internet has a decisive effect on the choice of a hotel.

However, Crick and Spencer (2011, pp. 463–478) point out that the quality of services cannot be measured similarly to the quality of manufac-

tured goods. In qualifying hotel satisfaction levels, Chaves *et al*. (2012, pp. 1286–1287) note that the most commonly used terms are "room", "staff" and "location". In the study by Xiang and Krawczyk (2016, pp. 383–395), the most frequent attributes mentioned were personnel, services, cleanliness, and location (Sim *et al*., 2006, pp. 1–23; Wang & Hung, 2015, pp. 92–101). According to Zhang *et al.* (2011, pp. 972–981), a value, location and cleanliness are the attributes that affect the overall performance of the hotel the most.

It has also been shown that equipment (Li *et al*., 2013, pp. 101–136), noise level in the room (Heung, 2000, pp. 308–315), cleanliness and maintenance (Lai & Hitchcock, 2017, pp. 107–129), safe and leisure environment (Lin *et al*., 2011, pp. 59–65) affect customer satisfaction. Other studies have revealed that the location of the hotel is the most important aspect of customer satisfaction. The research by Xu and Li (2016, pp. 57–69) claims that location is important in hotels with a limited, as well as full, service, while the research by Kim *et al*. (2016, pp. 10–17) confirmed this importance only for hotels offering full service. In the study by Limberger *et al*. (2014, pp. 59–65), the location was important only for those customers who chose the "Top Hotels" category. In addition, the ideal location is always associated with greater demand for accommodation (Lockyer, 2003, pp. 297–305). Chaves *et al*. (2012, pp. 1286–1287) analysed online hotel reviews and found out that customer satisfaction with hotel services is determined primarily by indicators relating to rooms, staff, location and hotel surroundings, while several studies have showed that free internet connection has become an essential element that can increase service quality (Xu & Li, 2016, pp. 57–69); Kucukusta, 2017, pp. 1956–1976; Bulut *et al*., 2015, pp. 2045–2058).

Among other things, research suggests that customer perception of hotel attributes varies according to the hotel type (Banerjee & Chua, 2016, pp. 125–131; Kim *et al*., 2016, pp. 10–17) and the type of travellers, especially solo travellers (Radojevic *et al*., 2015, pp. 247–258). Carneiro and Costa (2000, pp. 1–19) previously discussed how quality of service affected the competitive position of five-star hotels. Studies have also paid attention to the human factor. The usefulness of the information desk (Heung, 2000, pp. 308–315), accurate and fast professional services (Lin *et al.,* 2011, pp. 91–94) or reception services (Li *et al*., 2013, pp. 101–136) have been described as positive employee characteristics that affect customer satisfaction. Li *et al*. (2013, pp. 101–136) identified a parking space as another element that customers perceive as important and which has a significant effect on customer satisfaction. Albayrak and Caber (2015, pp. 43–50) identified food

and drinks, staff, room, beach, or air conditioning as the main attributes of a hotel (Radojevic *et al.*, 2015, pp. 247–258).

Stringam *et al.* (2010, pp. 773–796) studied the relationship between the overall guest satisfaction and hotel services, condition of hotels, room cleanliness, and room comfort. The results suggest that although partial correlations differ, overall satisfaction was positive. On the other hand, previous studies have revealed various findings which identified services, such as slow restaurant services, slow check-in/out (Lewis & McCann, 2004, pp. 6–17) or declining service quality (Lee & Hu, 2004, pp. 167–181) as the greatest failures. Another study showed that customers complain about the size of the room, the condition of the furniture and equipment in the room, the cleanliness of the room (Sparks & Browning, 2010, pp. 797–818; Barreda & Bilgihan, 2013, pp. 263–280) the most often while the cleanliness of the bedroom and the bathroom are common problems for hotel customers. In many studies, customer satisfaction with hotels is the most dominant feature as to its important role in gaining customer loyalty (Deng *et al.*, 2013, pp. 133–140). The high level of customer satisfaction could increase hotel's financial performance (Sun & Kim, 2013, pp. 68–77), but also increase hotel's efficiency (Assaf & Magnini, 2012, pp. 642–647).

## Research methodology

The primary aim of the present study is to evaluate the effect of selected service quality determinants (from the customer's perspective) on the sentiment polarity of the reviews left for the TOP hotels of the Visegrad Group. To meet the aim, we focused on the effect of variables indicating customer satisfaction with the services of selected hotels on the sentiment polarity found in customer reviews of the given hotels.

The main research data (sentiment polarity) was obtained from online booking portal Tripadvisor (2019) during the month of July, 2019. The data was collected using automated download from the web-web scraping. Our sample consisted of TOP accommodation facilities — hotels in the Visegrad Group. The term "top hotels" defines hotels with a five-star standard. The dates when the reviews were written were not taken into account when downloading data; the oldest reviews are from 2009. This variable was in the theoretical interval of -1 to 1, where -1 means extremely negative sentiment and 1 extremely positive sentiment. Independent variables (ranked on a scale of 1 to 10) were collected from the booking portal Booking (2019) and included — hotel location, personnel, cleanliness, comfort, ho-

tel amenities (equipment), price / quality ratio (P / Q ratio) and quality of Wi-Fi.

For data collection (web scraping), we used the method of automatic data collection through a script in the programming language PHP 7.3.3 in conjunction with MySQL 5.7.25 database. With the help of the above-mentioned technologies, a script has been created to identify and scrape relevant data from the website's source code.

In the first part of the analytical procedures presented in the following section, 22,000 customer reviews of the hotel accommodation facilities (N = 117) from the Visegrad Group countries were used (CZ = 39 — 33.3%; HU = 15 — 12.8%; PL = 56 — 47.9%; SK = 7 — 6%).

The results can be understood in three separate and consecutive units; in the first one, descriptive statistics was applied to all the above variables, the purpose of which was to complete the informative nature of the following analyses. The descriptive statistics included the following - total data rate (N) as well as the number of missing data (Missing N), central tendency characteristics — mean and median, variability in the form of standard deviation, position characteristics (Skewness, Kurtosis), Rande, minimum, maximum and quartile characteristics in the form of the first and third quartiles (Q1, Q3). This was followed by correlation analysis (Pearson r) and Variance inflation factor (VIF), the purpose of which was to verify the condition of multicollinearity, which according to Gauss-Markov theorem can significantly disrupt the application of linear regression models. Subsequently, linear regulatory models of linear regression analysis were applied, in which the condition of multicollinearity, since the cross validation technique was applied, is not decisive.

Ridge regression

$$SSE_{ridge} = \sum (y - \hat{y}) + \lambda \sum \beta^2 \tag{1}$$

Lasso regression

$$SSE_{lasso} = \sum (y - \hat{y}) + \lambda \sum |\beta| \tag{2}$$

Elastic net regression

$$SSE_{elastic\_net} = \sum (y - \hat{y}) + \lambda \left[ (1 - \alpha) \sum \beta^2 + \alpha \sum |\beta| \right] \tag{3}$$

Linear model of regression analysis

$$y_i = \beta_0 + \beta_1 X_i + ... + \beta_n X_p + \varepsilon_i \qquad (4)$$

After this analysis, the conditions of multiple linear regression analysis — OLS (VIF, residue variability constant, normality, outliers) were applied again. A suitable model was created and applied, and in the end, the prediction based on deciles of selected independent variables was outlined. In order to better understand the relations between variables, the correlation analysis was also applied synchronously to the regression model (Spearman ρ, Pearson r).

To process the data, we used the software R, version 3.6.0 (Planting of a Tree) and libraries such as car, lmtest, sandwich, caret, glmnet, ggplot2 and ggfortify.

**Results**

The following part of the analysis is divided into three follow-up units. The first part shows descriptive statistics of the data entering the analysis, the second part points to the increased level of multicollinearity and in the third part we applied a regression model with regulated parameters — RIDGE, LASSO and ELASTIC NET. The aim of this section was to find out how independent variables (Location, Personnel, Cleanliness, Eqt, Comfort, Ratio P / Q, Wifi) affect the dependent variable (sentiment polarity). In the next step, the regression analysis used only independent variables with a significant effect. A multiple linear OLS regression model was applied in this section.

Table 1 shows the basic descriptive statistics of the variables entering the analysis. The purpose of this analysis lies in completing the view of the output of the given variables in terms of the selected sample of hotels. If we look at the variable sentiment polarity, we see that it reaches a positive value in the minimum (0.0721), which can be evaluated positively, i.e. the hotel with the lowest rating has an average positive value. Polarity is understood in the interval from -1 to 1, where the more negative the value, the more negative the output, zero represents a neutral value. Quality variables (from location to Wi-Fi) also gain very high rates, sometimes attacking the upper limit 10, which is the most positive assessment possible. In the following part, we outline the assumptions resulting from the objective of this research, i.e. the effect of selected evaluation criteria on the polarity of sentiment.

As can be seen from Table 2, there is a connection between the selected independent variables that might be undesirable in the regression model (> 0.8), and hence there would be a problem with accepting the acceptable multicollinearity condition. This assumption is also confirmed by the variance inflation factor (VIF) that takes value 1.1528 for Location, 3.7480 for Personnel, 8.2583 for Cleanliness, 12.2623 for Eqt, 17.0822 for Comfort, 3.9243 for P / Q Ratio, and 1.5608 for Wifi. Thus, Eqt and Comfort reached an unacceptable rate, with the variable Cleanliness ranking just below the unacceptable rate. According to Gauss-Mark's theorem, multicollinearity is an effect that significantly disrupts BLUE (Best Linear Independent Model). Our intention is to point out first and foremost the effects of all selected variables using the GLM regulatory models like RIDGE, LASSO and Elastic Net models.

Regulatory parameter ($\alpha$, $\lambda$) is very important for these models. The procedure chosen was the decadic cross validation at ten repetitions. Based on the RIDGE models (1) with constant $\alpha$ equal to 0 and optimal $\lambda$ equal to 0.0001, for LASSO models (2) with constant $\alpha$ equal to 1 and optimal $\lambda$ equal to 0.0001 and for Elastic Net (3) models with $\alpha$ equal to 0.222 and $\alpha$ equal to 0.0001.

As shown in Table 3, there are no significant differences between models. However, if deviations need to be considered, let us focus on the RMSE outcomes of the central tendency, dominated by the Ridge model and the Lasso model. At the coefficient of determination, the Rigde model and the Elastic net model dominate the central tendency values. The following visualizations determine the importance of effects of selected variables on the polarity.

Figure 1 informs us about the importance of the effect of selected independent variables (quality perception) on the polarity of the analysed hotel facilities. As you can see, the greatest importance is placed upon equipment and cleanliness, followed by comfort and staff, while the location and ratio of price and quality of accommodation rank the last. According to the results, free Wi-Fi is not that important. The next step is a regression analysis, where the independent variables will consist of six variables that showed importance and the dependent variable will be represented by the polarity of sentiment in the analysed hotel facilities.

As independent variables tend to show significant multicollinearity tendencies, VIF of independent variables will be carried out in the first step. Equipment takes VIF 11.818468, Cleanliness 8.277308, Comfort 16.486781, Personnel 3.647321, Quality Ratio 3.713994, and Location 1.143526. Variables equipment and comfort show unacceptable values.

A suitable solution to this problem is to remove one of the high-correlation variables, in our case it will be the Comfort variable.

A model was created featuring the dependent variable of the sentiment polarity and the independent variables Equipment, Cleanliness, Personnel, Quality-Price, Position. The VIF of the Equipment variable is 5.456868, Cleanliness 6.910914, Personnel 3.634720, Quality- Price Ratio 3.504924, Position 1.122867. We rate the VIF rates as acceptable. According to the Gauss-Mark theorem, we place the highest importance on multicollinearity and heteroscedasticity, but other outputs (residual normality and outliers) shown in Figure 2 are also relevant.

As it is evident, the model is disrupted by some of the data evident from Figure 2. The outlier marked with number 108 has been deleted. This decision was also conditioned by the Bonferroni Outlier Test, which identified the presence of an apparently outlying value at a Boferoni's p value of $8.4047 \times 10\text{-}9$. Upon removal of this value, the Shapiro-Wilk Normality Residue Test was applied, which at a W value of 0.9869 showed a p value of 0.3268, which did not indicate deviations from the normal statistical distribution. One of the most important conditions of application of the regression analysis is the constant variability of residues, where this property was tested by the Breusch-Pagan heteroskedasticity test, where at 5 degrees of freedom and the BP value of 13.6230, the p value is 0.01819, thus indicating heteroskedasticity. Thus, an estimator HC3 was used to estimate statistical significance.

The coefficient of determination is approximately 0.4063 which can be considered acceptable. As can be seen from Table 4, the variables that can be considered significant at α 0.05 are Eqt, Cleanliness and Location. The Personnel and P / Q Ratio variables are significant at α 0.1.

We accept the opinion that the polarity of sentiment is significantly influenced by the selected elements of customer satisfaction with the services provided.

Although Eqt and Location acquire negative coefficient values, the model must be viewed as a whole. The negative coefficient values do not necessarily mean a decreasing tendency when looking at a particular variable, as evidenced by the outputs of all independent variables and the sentiment polarity.

Table 5 is devoted to a bivariate analysis of correlation (Pearson r, Spearman ρ). In all values, the analysed part shows positive rates. Returning to the previous regression model, information illustrating the overall understanding of the model is prediction. The predictive input data for each independent regression model variable (Eqt, Cleanliness, Personnel, P / Q Ratio, Location) are deciles specific to each independent variable.

From the prediction shown in Figure 3, it is possible to conclude an upward trend, i.e. if the values of Eqt, Cleanliness, Personnel, P / Q Ratio, Location increase, the sentiment polarity will increase, too, with the Cleanliness variable being the most important, followed by Eqt and Location while P / Q Ratio and Personnel are almost insignificant.

**Discussion**

The results of our study show that the greatest influence on the polarity of sentiment can be attributed to the hotel equipment and cleanliness. Cleanliness is one of the most important evaluation criteria of hotel services evaluation and our findings are consistent with other studies. For example, Lai, and Hitchcock (2017, pp. 107–129), identified the structure of service quality factors in terms of satisfaction with luxury hotels in terms of new, recurring, and frequent travellers to Macao. The results of this study confirm that cleanliness has a great effect on customer satisfaction. Other studies, such as that by Kim *et al*. (2016, pp. 10–17), which analysed online hotel reviews to identify and compare factors that satisfy and dissatisfy hotel customers based on Herzberg's two-factor theory, confirmed that insufficient cleanliness can cause customer dissatisfaction. Cleanliness, actually, plays a huge role in the comfort of hotel guests during their stay. Zhang *et al.* (2011, pp. 972–981) emphasizes that cleanliness is an important factor affecting customers when choosing a hotel. Also, the research by Rauch *et al*. (2015, pp. 87–106), which focused on two types of hotels — upscale (4-star) and luxury (5-star), indicated that general room cleanliness was an important factor for consumers of both types of hotels.

The results of our analysis from the point of view the variable Location are consistent with other studies, too. The location of the hotel was also recognized in Xiang and Krawczyk (2016, pp. 383–395) as the main determinant of guest satisfaction in hotels in Manhattan, New York. The findings of this study indicate that there are several factors related to the location of the hotel, such as "shopping", "attractions", or "noise". Our results are also supported by Sim *et al*. (2006, pp. 1–23) who considers the location and availability of the hotel to be very important in terms of customer satisfaction, as great location provides customers with a pleasant view of the surroundings and saves time when going sightseeing. However, different findings were reported by Ortiz-Rendon *et al*. (2018, pp. 1457–1468), who examined the level of satisfaction of hotel service consumers in Colombia. Even though the location and infrastructure of the hotel were not significant evaluation criteria in this study, the results of the analysis do not

indicate that they do not affect the overall customer satisfaction. This statement is also supported by Zhou *et al*. (2014, pp. 1–10), who states that these are variables that tourists can easily evaluate before traveling and, therefore, do not have a decisive weight in customer evaluation. However, the findings of our research continue to be consistent with the results of the study by Wang and Hung (2015, pp. 92–101) who, based on the analysis of online reviews, emphasize that the location of guest houses in China has a significant effect on customer satisfaction.

Although the human factor is essential for the provision of services in accommodation facilities, according to the results of our study, the equipment of the hotel has the greatest effect on the polarity of sentiment. These findings were also supported by other studies investigating the effect of hotel service quality on customer satisfaction. Li *et al*. (2013, pp. 101–136) examined 42,668 online travel reviews covering 774 hotels. The study focused on parking lots, high-quality bathroom fabrics or lighting as elements that customers perceive as important and significant in influencing customer satisfaction. With regard to the equipment of the hotel, we found that the study by Kim *et al*. (2016, pp. 10–17) is consistent with our results, as it concluded that the size of the rooms is particularly important for customers looking for affordable hotels.

Based on the results of the regression analysis, the hotel staff proved to be yet another important evaluation criterion influencing the perception of the quality of hotel services (at the alpha level <0.1). Employee performance is the second most influential customer satisfaction factor, according to the research by Xu and Li (2016, pp. 57–69) which also found out that friendly, courteous, and helpful employees generate a higher level of customer satisfaction. Our findings are also consistent with those by Lai and Hitchcock (2017, pp. 107–129), whose research on luxury hotels has revealed that employees' ability to meet the customers' needs is an important factor in customer satisfaction. These findings are also consistent with the research of Berezin *et al*. (2016, pp. 1–24), who analysed online customer reviews across Sarasota, Florida, to understand which aspects of a hotel affect customers' hotel experience the most. The research confirms that hotel staff is the most influential determinant contributing to the customer satisfaction and is truly considered to be the main attribute of any hotel.

In our study, the price-quality ratio has also proven to be a significant attribute affecting the polarity of sentiment. Its importance is largely supported by the research by Rajaguru and Rajesh (2016, pp. 4613–4616). Based on the analysis of 1,023 entries collected from hotel reviews, the authors suggest that hotel managers should ensure that customers receive value for money they spend, because value for money significantly contrib-

utes to the overall satisfaction of hotel guests. Mohsin and Lockyer (2010, pp. 160–173) even rated value for the money as one of the most important quality attributes of luxury hotels, in particular.

As far as results are concerned, it should be noted, among other things, that Wi-Fi has no (or negligible effect) effect on the polarity. However, these results contradict the research by Radojevic *et al.* (2015, pp. 247–258) who examined the customer satisfaction factors on a sample of 6,768 hotels located in 47 major cities of Europe. The study's findings show that, among other factors, access to free Wi-Fi has a strong positive link to customer satisfaction. Kucukusta (2017, pp. 1956–1976) examined how Chinese tourists rate the hotel facilities when booking hotel rooms in Hong Kong. His study concluded that price, shuttle service and Wi-Fi were rated as relatively important evaluation criteria of hotel quality. This statement is also supported by Crick and Spencer (2011, pp. 463–478), who declared that there has not been a high demand for Wi-Fi in hotel services in the past, but now the convenience of the internet access is a major factor customers pay attention to when booking hotels. Victorino *et al.* (2005, pp. 555–576) also claim that leisure travellers are more affected by innovative hotel amenities than business travellers are. However, the results of the study by Lee and Tussyadiah (2010) point to the exact opposite. On the other hand, Berezin and Cobanoglu (2010, pp. 25–37) emphasize the difference between men and women and their attitude to the internet access. They found that men more than women consider internet access to be an important factor.

From the manager's point of view, the analysis of online reviews can be seen as a key to understanding customer's perception of the hotel. Consequently, this opportunity can lead not only to the improvement of the quality of hotel attributes and greater customer satisfaction, but also to the development of effective marketing strategies or innovative management methods. Correct identification of key factors which lead to customer satisfaction can help companies in their effort to achieve a competitive advantage.

## Conclusions

The primary objective of this study was to assess the significance of the effect of the quality of services provided on the hotel perception by customers, i.e. how the evaluation of selected aspects of service quality affects the polarity of sentiment. This aim was achieved by a sequence of analyses that unequivocally confirm a positive and in many aspects very significant

effect. The regulatory models RIDGE, LASSO and ELASTIC NET, the aim of which was to determine the importance of the effect of Location, Personnel, Cleanliness, Equipment, Comfort, Price/ Quality Ratio, Wi-Fi on the polarity sentiment, were used in the regression analysis. Subsequently, a multiple regression analysis was applied, however, the variable Comfort was excluded due to high multicollinearity. The coefficient of determination of the described model is approximately equal to 0.4063, i.e. approximately 41% of the variability sentiment polarity is explained by variables such as Location, Personnel, Cleanliness, Eqt, P / Q Ratio. Eqt, Cleanliness and Location can be considered significant at the level of $\alpha$ 0.05, Personnel and P / Q Ratios are significant at the level of 0.1.

For the sake of completeness of the interpretation, a prediction graph was drawn up where the inputs of the independent variables were deciles of specific variables. In this respect, it is possible to speak of a slightly increasing tendency of the figure. A bivariate analysis of the relationship between polarity sentiment and all other variables mentioned above was also applied. The overwhelming majority of tests showed a significant correlation, and in all cases there was a positive and relatively high correlation.

The presented research also determines the outputs from the applied perspective, where it is necessary to emphasize the importance of the effect of individual areas of satisfaction on the perception of the selected sample of hotels. This idea is supported by many economic, managerial or marketing theories, which emphasize meeting customer needs, maximizing added value, which is reflected in the evaluation, recommendations and ultimately in shaping the competitive advantage and subsequently meeting the economic goals of the organization. With regard to the results, it is worth noting that Wi-Fi has no (or negligible ) effect on polarity, as it is a common standard for hotels of the highest category. In general, hotels should put the utmost emphasis on the equipment and cleanliness of the hotel.

Research limitations include an incomplete lexicon of positive and negative words and a subjective nature of reviews. Although the pattern is likely to be negligible, it is not possible to quantify the significance of these effects. It should also be noted that, although countries in question are very closely related in several respects, an effect that would distort the results might have taken place.

As has been shown, equipment and cleanliness are very closely linked to the sentiment polarity, i.e. with changes in satisfaction. Future research ambitions will be in primary research applications, where we will focus on a more particular understanding of the effects of cleanliness and equipment on satisfaction. Cleanliness as well as equipment can take on different dimensions (e.g. staff cleanliness, effective cleanliness, visual cleanliness,

branded equipment, functional equipment, etc.). Satisfaction can also be measured in several ways. In primary research, it is possible to assume that satisfaction is the difference between expectations and reality. Clients will most likely have different expectations depending on the type and quality of the accommodation, the destination or, last but not least, their education, age and gender characteristics.

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# Annex

**Table 1.** Descriptive statistics of all research variable

|  | Sentiment polarity | Location | Personnel | Cleanliness | Eqt | Comfort | Ratio P/Q | Wifi |
|---|---|---|---|---|---|---|---|---|
| N | 117 | 117 | 117 | 117 | 117 | 117 | 117 | 115 |
| Missing N | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Mean | 0.3820 | 9.2650 | 9.0094 | 9.2231 | 8.8359 | 9.0436 | 8.3333 | 8.5826 |
| Median | 0.3881 | 9.3000 | 9.1000 | 9.3000 | 8.9000 | 9.1000 | 8.4000 | 8.7000 |
| Std. Deviation | 0.0614 | 0.4581 | 0.4152 | 0.4229 | 0.4746 | 0.4358 | 0.4601 | 0.7265 |
| Skewness | -1.7383 | -0.9246 | -0.6426 | -1.0471 | -0.7580 | -0.8752 | -0.6939 | -1.5923 |
| Kurtosis | 6.3400 | 0.4871 | 0.6100 | 0.9783 | 0.6420 | 1.1856 | 0.7180 | 3.7646 |
| Range | 0.4764 | 2.1000 | 2.2000 | 2.1000 | 2.4000 | 2.4000 | 2.3000 | 4.4000 |
| Minimum | 0.0721 | 7.8000 | 7.6000 | 7.8000 | 7.4000 | 7.4000 | 6.8000 | 5.6000 |
| Maximum | 0.5486 | 9.9000 | 9.8000 | 9.9000 | 9.8000 | 9.8000 | 9.1000 | 10.0000 |
| Quartile 1 | 0.3594 | 9.0000 | 8.8000 | 9.0000 | 8.6000 | 8.8000 | 8.1000 | 8.3000 |
| Quartile 3 | 0.4184 | 9.6500 | 9.3000 | 9.5000 | 9.2000 | 9.3000 | 8.7000 | 9.1000 |

**Table 2.** Independents variables – analysis of relationship

| Pearson r | Location | Personnel | Clean | Eqt | Comfort | Ratio P/Q | Wifi |
|---|---|---|---|---|---|---|---|
| Location | x | 0.305 | 0.289 | 0.219 | 0.275 | 0.258 | 0.239 |
| Personnel | 0.001 | x | 0.824 | 0.771 | 0.788 | 0.786 | 0.555 |
| Clean | 0.002 | 0.000 | x | 0.896 | 0.923 | 0.811 | 0.516 |
| Eqt | 0.018 | 0.000 | 0.000 | x | 0.954 | 0.790 | 0.495 |
| Comfort | 0.003 | 0.000 | 0.000 | 0.000 | x | 0.824 | 0.484 |
| Ratio P/Q | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | x | 0.551 |
| Wifi | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | x |

**Table 3.** Model relevancy (power) output

|  |  | Min. | Q1 | Median | Mean | Q3 | Max. |
|---|---|---|---|---|---|---|---|
| **RMSE** | Ridge model | 0.0228 | 0.0334 | 0.0428 | 0.0478 | 0.0519 | 0.1130 |
|  | Lasso model | 0.0203 | 0.0354 | 0.0417 | 0.0479 | 0.0543 | 0.1056 |
|  | Elastic net model | 0.0180 | 0.0348 | 0.0420 | 0.0479 | 0.0490 | 0.1204 |
| **R²** | Ridge model | 0.0000 | 0.1565 | 0.4200 | 0.4036 | 0.5994 | 0.8526 |
|  | Lasso model | 0.0002 | 0.1220 | 0.3953 | 0.4009 | 0.6732 | 0.8437 |
|  | Elastic net model | 0.0006 | 0.1617 | 0.4364 | 0.4034 | 0.5710 | 0.8148 |

**Table 4.** OLS regression model output

|  | Estimate | Std. Error | t value | Pr(>\|t\|) |
|---|---|---|---|---|
| (Intercept) | -0.2555 | 0.1283 | -1.9914 | 0.0489 |
| Eqt | -0.0730 | 0.0257 | -2.8461 | 0.0053 |
| Clean | 0.0994 | 0.0318 | 3.1235 | 0.0023 |
| Personnel | 0.0375 | 0.0225 | 1.6626 | 0.0992 |
| Ratio P/Q | 0.0246 | 0.0129 | 1.9064 | 0.0592 |
| Location | -0.0188 | 0.0092 | -2.0540 | 0.0423 |

**Table 5.** Relations dependent variable with independents variables – r, ρ

| sentiment polarity | Location | Personnel | Clean | Eqt | Comfort | Ratio P/Q | Wifi |
|---|---|---|---|---|---|---|---|
| Sig. r | 0.845 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.035 |
| Value r | 0.018 | 0.465 | 0.479 | 0.326 | 0.408 | 0.441 | 0.197 |
| Sig. ρ | 0.731 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.009 |
| Value ρ | 0.032 | 0.451 | 0.527 | 0.387 | 0.478 | 0.477 | 0.241 |

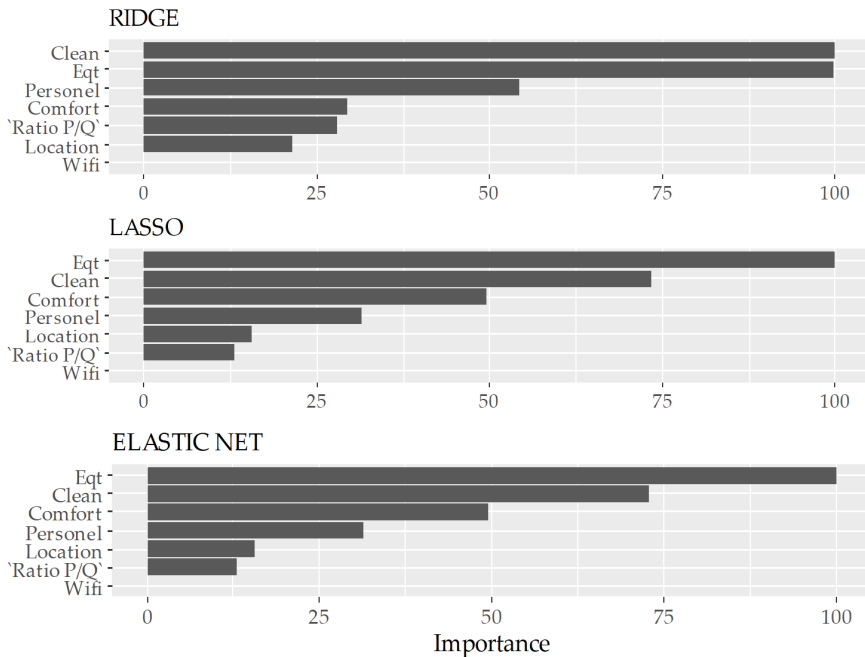**Figure 1.** Importance of the effect of selected independent variables on dependent variables
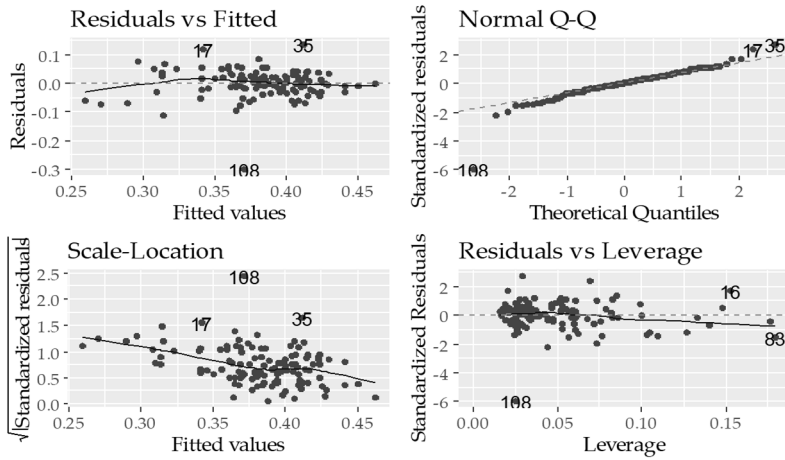
**Figure 2.** Visualization of model properties



**Figure 3.** Prediction Y in deciles form independents variables